national accelerator laboratory

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0629

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PROCEDURE FOR VACUUM IMPREGNATION OF EPB MAGNETS

R. E. Juhala

1. The magnet is preheated to a temperature in the range of 120° to 140° F. Then it is outgassed for a period of 4 hours at this temperature while maintaining a vacuum of 200 microns or less. (Note: This outgassing period may be done at higher temperatures if desired; however, the magnet must be brought to below 140° F before filling with epoxy.)

2. The resin mixture is vacuum degassed as per NAL Specification #0621-ES-19434, Section 10.5[1], for approximately 30 minutes. (Note: The use of a cold trap on the pumping line is essential to protect the vacuum pump from contamination.)

3. The resin mixture is specified in NAL Specification #0621-ES-19434, Section 10.4[2], with the addition of tabular alumina to reduce problems of shrinking, cracking, to provide a more rigid structure, and in the case of the quadrupoles, provide for better heat transfer between copper and cooling tubes.

   A. Dipoles. A 1 to 1 mixture of alumina to resin by weight is recommended; however, to permit a more rapid fill, a 1 to 2 mixture of alumina to resin is acceptable providing this is followed by a flush through of a 1 to 1 mixture.

   B. Quadrupoles. A 1 to 1 mixture of alumina to resin is required. (Note: The term resin is taken to mean resin, hardener, and accelerator. By preheating the resin to 120-140° F, it will thin out to a consistency much like that of house paint and will aid in the filling process.)

4. The normal filling time for a dipole is approximately one hour; the quadrupole will require two or more hours. To avoid premature curing of the resin, the magnet temperature should be maintained below 140° F during the filling.

   After the fill and during bakeout, header pipes at both ends of the magnet at least 18" above the top of the magnet

should be maintained (in practice the more head above the better). These header pipes should be kept cool so that the epoxy will not set in them and so they will provide the additional epoxy required as complete penetration is achieved during bakeout.

During the fill the vacuum can be expected to deteriorate somewhat as the epoxy continues to outgas; however, this should not affect the quality of the impregnation provided the pumping line is at the high point of the magnet so no trapped gas can remain.

5. The curing cycle is as specified in NAL Specifications #0624-ES-19654, Section 8.9 and #0624-ES-19434, Section 10.6. This consists of four hours at 80° C followed by ten hours at 125° C. The most acceptable method for bake-out is to place the magnet in an oven so that uniform heat is present at all points.

[1]or NAL Specification #0624-ES-19654, Section 8.8

[2]or NAL Specification #0624-ES-19654, Section 8.7